

## 2. ANIMAL WASTE CHARACTERISTICS

The quantity and composition of wastes produced influence livestock waste facility design. The properties of manure depend on several factors: animal species; ration digestibility, protein, and fiber content; and animal age, environment, and productivity. The waste system also handles added bedding, soil, water, hair, etc.

Waste with 20%-25% solids content (75%-80% moisture content) can usually be handled as a solid, i.e. it can be stacked and can be picked up with a fork loader. Liquids need to be drained and the waste dried or bedding added to get solid waste. In the 10%-20% solids content range, handling characteristics vary depending on the type of solids present. In this range,

the percent solids content does not necessarily define handling characteristics.

Waste with 4%-10% solids content can usually be handled as a liquid, but may need special pumps. Waste with 0%-4% solids content is handled as a liquid with irrigation or flushing consistency. Liquids which have had the larger solids settled or filtered out or wastes with dilution water added may have 4% or less solids.

### Manure

Table 2-1 lists manure properties. Because of the variations in animal manure properties, the values

**Table 2-1. Manure production and characteristics as produced.**

Values are approximate. The actual characteristics of a manure can easily have values 20% or more above or below the table values. The volume of waste that a waste handling system has to handle can be much larger than the table values due to the addition of water, bedding, etc. For example, liquid waste systems for swine farrowing and gestation units may have to handle twice as much waste volume as indicated; swine nurseries 3 to 4 times as much, because of large amounts of wash and wasted water.

Animal	Size lb	Total manure production			Water %	Density lb/day	TS lb/ft <sup>3</sup>	VS lb/day	BOD <sub>5</sub> lb/day	Nutrient content, lb/day		
		lb/day	lf/day	gal/day						N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Dairy cattle	150	12	0.19	1.5	87.3	62	1.6	1.3	0.26	0.06	0.023	0.048
	250	20	0.32	2.4	"	"	2.6	2.1	0.43	0.10	0.045	0.084
	500	41	0.66	5.0	"	"	5.2	4.3	0.86	0.20	0.082	0.169
	1,000	82	1.32	9.9	"	"	10.4	8.6	1.70	0.41	0.166	0.325
	1,400	115	1.85	13.9	"	"	14.6	12.0	2.38	0.57	0.232	0.458
Beef cattle	500	30	0.50	3.8	88.4	60	3.5	3.0	0.8	0.17	0.127	0.145
	750	45	0.75	5.6	"	"	5.2	4.4	1.2	0.26	0.191	0.229
	1,000	60	1.00	7.5	"	"	6.9	6.0	1.6	0.34	0.250	0.289
	1,250	75	1.20	9.4	"	"	8.7	7.4	2.0	0.43	0.318	0.373
Cow*		63	1.05	7.9	"	"	7.3	6.2	1.7	0.36	0.273	0.313
Swine												
Nursery pig	35	2.3	0.038	0.27	90.8	60	0.20	0.17	0.07	0.016	0.0118	0.012
Growing pig	65	4.2	0.070	0.48	"	"	0.39	0.31	0.13	0.029	0.0223	0.024
Finishing pig	150	9.8	0.16	1.13	"	"	0.90	0.72	0.30	0.068	0.050	0.054
	200	13.0	0.22	1.5	"	"	1.20	0.96	0.39	0.090	0.068	0.071
Gestating sow*	275	8.9	0.15	1.1	"	"	0.82	0.66	0.27	0.062	0.048	0.048
Sow and litter*	375	33.0	0.54	4.0	"	"	3.00	2.40	1.00	0.230	0.173	0.181
Boar*	350	11.0	0.19	1.4	"	"	1.00	0.84	0.35	0.078	0.059	0.061
Sheep	100	4.0	0.062	0.46	75.0	65	1.00	0.85	0.09	0.045	0.015	0.039
Poultry												
Layers	4	0.21	0.0035	0.027	74.8	60	0.053	0.037	0.014	0.0029	0.0025	0.0014
Broilers	2	0.14	0.0024	0.018	"	"	0.036	0.025	0.0023	0.0024	0.00123	0.0009
Horse	1,000	45	0.75	5.63	79.5	60	9.4	7.5	—	0.27	0.105	0.205

Source: American Society of Agricultural Engineers, data adapted from Committee S&E-412 report AW-D-1. Revised 6-14-73.

Density = best estimate, not ASAE data

TS = total solids

VS = volatile solids

BOD<sub>5</sub> = the oxygen used in the biochemical oxidation of organic matter in 5 days at 68 F. A standard test to assess wastewater strength.

N = total nitrogen

Elemental P (Phosphorus) = 0.44 x P<sub>2</sub>O<sub>5</sub>

Elemental K (Potassium) = 0.83 x K<sub>2</sub>O

\*Not ASAE data.

Assumptions:

Cow = 1.05ftV/day

Gestating sow = 1/2 of ASAE data for her weight because she is limit fed

Sow and litter = ASAE data for her weight + 8 pigs at 1.0 lb/day

Boar = 1/2 of ASAE data for his weight because he is limit fed